



MONITORING OF FOREST RESOURCES USING REMOTE SENSING TECHNOLOGY

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ABSTRACT

Forest and forest land is an important natural resource in the environment which plays a vital role in maintaining the ecological balance and bio-diversity. However the forest resources are decreasing due to natural and anthropogenic processes. Some of the reasons could be rapid population growth, urbanization, modernization and industrialisation. There is an increasing concern at Regional, National and Global level for conservation of the existing forest and bringing more area under forest cover. To achieve this, the best possible way is through the application of Remote Sensing and Geographical Information Systems (GIS) technologies.



Remote Sensing usually refers to the technology of acquiring information about the Earth surface and atmosphere using sensors onboard air-borne or space-borne platforms. Satellite Remote Sensing provides synoptic and multi-temporal coverage of large areas in near real time and offer capabilities for accurate assessment and management of natural resources. It has been of great use in monitoring natural resources at National, Regional and sub-regional levels in recent years. The present study is a step in that direction with a view to studying the forest covers of the southern parts of the Eastern Ghats of East Chittoor Division of Andhra Pradesh using Remote sensing data.

KEY WORDS: Remote Sensing, Chittoor Division, Monitoring, Sensor

INTRODUCTION:

Forest and forest land is an important natural resource in the environment which plays a vital role in maintaining the ecological balance and bio-diversity. Generally at least one third of area of any region should be covered by forest so as to sustain this ecological balance and bio-diversity. However the forest resources are decreasing due to natural and anthropogenic processes. Some of the reasons could be rapid population growth, urbanization, modernization and industrialisation. Due to over extraction of natural resources, tropical forests in India are being increasingly fragmented. Deforestation, in recent times cited as one of the major causes of habitat fragmentation thereby impacting on biodiversity. In addition to loss of biodiversity ecological, social and economical consequences are some other problems due to the depletion of forest. Forests, being a renewable resource play a vital role and occupy unique position among other natural resources, as they support life on earth and their services can't be substituted by any other means. In developing countries like India dependence on forests by many people is common and inevitable. As a result, there is loss of forest cover at an alarming rate particularly in the Eastern Ghats. There is an increasing

concern at global to sub regional level for conservation of the existing forests and bringing more area under forest cover. This is required to reduce global warming and atmospheric carbon. To achieve the above objectives, annual forest cover change assessment is essential to pinpoint areas of deforestation and greening with remote sensing techniques.

Remote sensing can play a vital role in providing accurate and reliable information of Earth with lesser cost and time when compared to traditional methods. Remote sensing technology has been of great use in monitoring natural resources at Global, National, regional and sub regional levels. It has the greatest comparative advantage when the scale is small, because it can provide data for a large area at one time (Van Lynden and Kuhlmann 2002), and it is, in principle, an ideal methodology for regional or global degradation assessments. This is one of the reasons why remote sensing is most often used for degradation assessments of relatively small areas. Recently considerable research has been carried out using remote sensing. Remote sensing now routinely provides environmental information at scales from the local to global. Satellite remote sensing combined with ground measurements plays a key role in determining loss of forest cover (Kumar *et al.*, 2010)

The loss and decline of native vegetation can have serious implications on the biodiversity of the landscape. The Eastern Ghats have long been recognised as a major centre of plant diversity with several species of rare and endangered floral and faunal elements. The Eastern Ghats constitute an important biogeographic region in the Indian sub-continent ranging from Orissa, Andhra Pradesh to Karnataka and Tamil Nadu and spread over an area of about 75,000 square kilometers through a chain of fragmented and disjunctive hill ranges.

The overall vegetation structure of these hill ranges comprises several forest vegetation types including tropical dry deciduous, mixed dry deciduous, dry evergreen forests, scrub or thorn forests, riverine forests and small patches of evergreen forests.

The present study is a step in that direction to monitor the forest covers of the Southern parts of the Eastern Ghats of East Chittoor district Forest division in Andhra Pradesh using LISS-III images of Indian Satellite IRS P6.

OBJECTIVES

The primary objective of this study is to prepare mapping of the existing vegetation of the region with a focus on land use and land cover and to study land use patterns in and around the natural forest patches.

STUDY AREA

Chittoor East Forest Division situated in the south of Andhra Pradesh and Eastern Part of Chittoor District between latitudes 13°1'7.32" and 13°55'28.56" N and longitudes 78°46' 50.88" and 80° 03'10.44" E and occupies an area of 6,769.18 square Km, which constitutes 44.58 % of the total area of the District and 8% of the State. The Eastern Ghats are predominant in the western region and they gradually bend towards the sacred Sheshachalam hills of Tirupati i.e. East division, passing through Chandragiri erstwhile taluk and entering into Nellore district. There is a plateau of average height of 800 m MSL. The Division having Eastern Ghats an altitude of 1152.70 m. lies in sub tropical semi-arid region of Northern hemisphere.

The climate of this region is dry but healthy and pleasant. The temperatures ranging from 12°C to 36°C and can rise up to 45°C during the summer. The average annual rainfall is about 88cm, received mainly from the South-West and North-East Monsoons. The rivers of the region are Kalyani, Swarna Mukhi and Arani.

DATA BASE AND METHODOLOGY

For forest cover study the following data have been used. I.S.O Topo sheets on 1:50000 Scale No.57K14-16,57O/2,3,4,10,11,12,14 and 15 Satellite images of IRS-P6 LISS-III path 101 and 102, resolution 25.3 metres, and Ground truth verification.

The methodology for the present study was carried out through a combination of surveys, field techniques, satellite data processing and data analysis. The data analysis includes assessment of the forest cover and land use distribution pattern relevant to the landscape of the region with ERDAS IMAGINE8.7 and GIS9.3

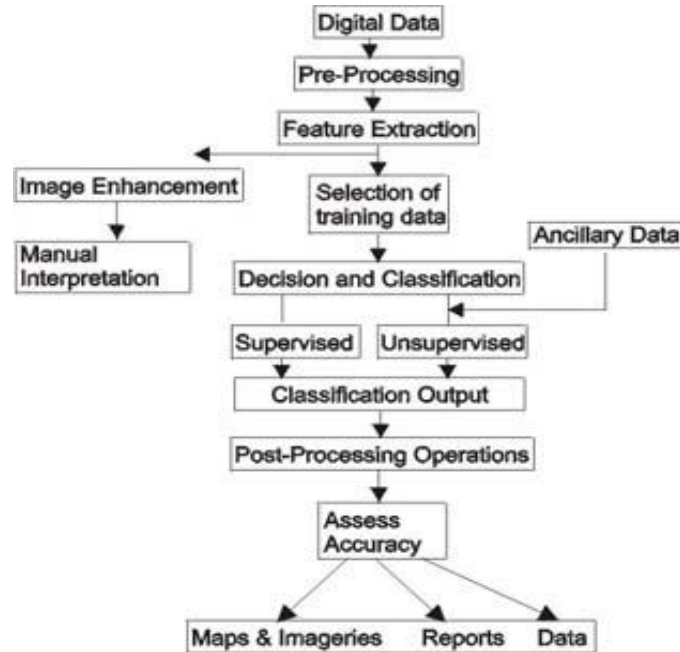


Figure1: Flow chart showing the Methodology

ANALYSIS

The data analysis includes assessment of the forest cover and land use distribution pattern relevant to the landscape of the region. Three main methods of data analysis were adopted in this study

1. Maximum likelihood classification.
2. NDVI Calculation.
3. Overlay operation.

RESULTS:

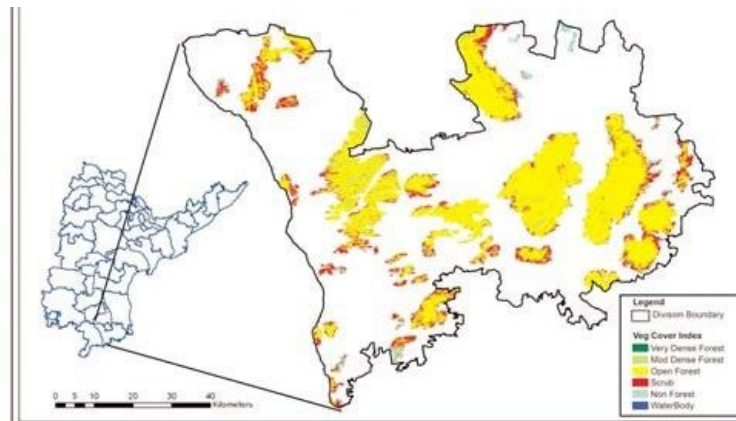
Land Use Pattern

The total notified forest area of the Division is 2452.08 Km², which is 36.22% of the total Geographical area. Reserved, Protected Forests Constitute 1976.68 Km² (80.61%), 475.4 Km² (19.39%) of the total forest area respectively. As per Champion and Seth's classification, the Forests of Division fall under Dry tropical South Indian dry mixed deciduous forests, Southern catch thorn forest groups & Tropical dry evergreen forests and Forest types.

Dry deciduous forests, thorn forests and scrub vegetation constituted 38 percent of the forest cover. Dry deciduous forest constituted a substantial part covering of Andhra Pradesh these forests occupied 1,518 square kilometres mainly in the Seshachalam hills including other deciduous forest.

Forest Cover:

The forest cover of the region based on the interpretation of IRS P6 LISS III 2009 data is 1444.29 Km², which constitutes 21.34% of the total Geographical area. In terms of the forest canopy density classes the region has 0.02 Km² of very Dense Forest, 114.71 Km² of Moderately Dense Forest, and 1329.56 Km² of Open Forest. The area of the Scrub is 364.9 Km², Non-Forest 191.67 and Water Bodies 0.45 Km². The Distribution of the forest cover of the division is shown in map below (Figure2).

Figure2:Forest cover map of East Chittoor Division 2008-2009**Fauna:**

In the forests of this division at present wild animals like tiger and panther (*Panthera pardus*) are present in small numbers. Comparison of the current forest cover (Satellite data of Dec 2008- Feb 2009) with that of previous assessment (Satellite Imagery of 2008- oct 2009) shows a net loss of 69.92 Ha of forest cover during the period of one year. • The change matrix, given in Table 4 reveals that there has been a decrease of 0.70 Km² of Open Forest. On the basis of ground truthing, the main reasons for decrease in forest cover is due to encroachments and clearance for rising of plantations.

CONCLUSION

The study was conceived with a view to determining the present status of the land use of the southern part of the Eastern Ghats including delineating the broad class vegetation types in the Eastern Ghats. The use of Remote Sensing and GIS as a tool for natural resources mapping has been amply demonstrated through this assessment of the vegetation types of the Eastern Ghats. While the forest cover analysis shows that nearly 38 % of the study area is characterised by forest habitats, there is also increasing pressure to these forests through developmental activities. The loss and decline of native vegetation can have serious implications on the biodiversity of the landscape. The eastern ghats which have long recognized as a major centre of plant diversity with several species of rare and endangered floral and faunal elements. Several floral elements of this landscape have a narrow distributional range and any adverse impact on their habitats can lead to serious decline in the native populations of these species. Using satellite-based tools for the monitoring of floral communities can provide valuable inputs for decision makers (Jayakumar et al 2002). Conservation efforts by various agencies including governments and NGOs have been partially successful in the past in halting the growing pressures to these forests. Prioritisation and conservation of sensitive bio-rich patches like the Nallamalais, Seshachalam hills, is therefore necessary to strengthen and maintain gene flow amongst various biodiversity and natural resource base. The exploitation of native species in Reserve Forests of this region despite protection suggests continuing loss of a gene pool, which might be valuable. The present study has only reiterated the fragile nature of our ecosystems and using such technologies like Remote Sensing can give greater insights into better understanding of our ecosystems for their protection.

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